WHAT IS CLAIMED IS :

1. Method for forming piezoelectric/electrostrictive film element at low temperature using electrophoretic deposition, the method comprising the steps of :

A) preparing a solution or a dispersed mixture containing constituent ceramic elements by dissolving or dispersing the raw material of constituent ceramic elements in a solvent or a dispersion medium;

B) preparing a mixed solution by adding citric acid into said solution or said dispersed mixture in which said constituent ceramic elements are dissolved or dispersed;

C) getting ultrafine ceramic oxide powder of particle size less than 1 μm with uniform particle diameter size distribution by forming ceramic oxide without scattering over, by nonexplosive oxidative-reductive combustion reaction by thermally treating said mixed solution at 100-500°C;

D) preparing a suspension by dispersing said ultrafine ceramic oxide powder in an organic dispersant;

E) preparing ceramic sol solution by dissolving constituent ceramic elements of same or similar constituent with said ultrafine ceramic oxide powder in water or an organic solvent;

F) dispersing by mixing said suspension in which said ultrafine ceramic oxide powder is dispersed with said ceramic sol solution;

G) forming a piezoelectric/electrostrictive film element by submerging a substrate into said suspension which said ultrafine ceramic oxide powder and said ceramic sol solution are mixed and then by performing electrophoretic deposition; and

H) thermally treating said piezoelectric/electrostrictive film element at 100-600°C ,

so that said solvent is removed by said thermal treatment and

the bonding among said ultrafine ceramic oxide powder particles is induced while said ceramic sol acts as a reaction medium on the surfaces of said ceramic oxide particles.

2. The method in Claim 1, further comprising the step of:

thermally treating said ultrafine ceramic oxide powder at 700-900°C before D).

3. The method in Claim 1 or Claim 2, further comprising the step of:

drying said piezoelectric/electrostrictive film between G) and H).

4. The method in Claim 3, wherein said piezoelectric/electrostrictive film is dried at 70-100°C.

5. The method in Claim 1 or Claim 2, wherein the particle size of said ultrafine ceramic oxide powder is 0.01-0.1 μm.

6. The method in Claim 1, wherein said substrate is made of metal, resinous polymeric organic compound, or ceramic.

7. The method in Claim 6, wherein said metal is nickel (Ni) or stainless steel.

8. The method in Claim 6, wherein said resinous polymeric organic compound is polyester, polyimide, or teflon-based resin.

9. The method in Claim 6, wherein said ceramic is alumina (Al_2O_3), zirconia (ZrO_2), silicon (Si), silicon carbide (SiC), silicon nitride (Si_3N_4), silicon dioxide (SiO_2), or glasses.

10. The method in Claim 1, wherein said ultrafine ceramic

oxide includes lead (Pb), zirconium (Zr) and titanium (Ti).

11. The method in Claim 10, wherein said ultrafine ceramic oxide is PZT, PMN or their solid solution (PZT-PMN) complex oxide.

12. The method in Claim 11, wherein said ceramic oxide powder further includes one or more element among nickel (Ni), lanthanum (La), barium (Ba), zinc (Zn), lithium (Li), cobalt (Co), cadmium (Cd), cerium (Ce), chromium (Cr), antimony (Sb), iron (Fe), yttrium (Y), tantalum (Ta), tungsten (W), strontium (Sr), calcium (Ca), bismuth (Bi), tin (Sn) and manganese (Mn).

13. The method in Claim 1, wherein said organic dispersion medium in which said ultrafine ceramic oxide powder is dispersed is alcohols or acetones.

14. The method in Claim 1, wherein the content of said organic dispersant is 1-500 ml ~~per~~ gram of the ultrafine ceramic oxide powder which is dispersed.

15. The method in Claim 1, wherein said organic solvent which is a base of said ceramic sol solution is acetic acid, dimethyl formamide, methoxyethanol, alcohols, or glycols.

16. The method in Claim 1, wherein the content of said ceramic sol solution is 1-500 parts by weight based on the weight of said ceramic oxide powder when said suspension of said ultrafine ceramic oxide powder and said ceramic sol solution are mixed.

17. The method in Claim 1, wherein the thickness of said piezoelectric/electrostrictive film element is 1-100 μm.

18. The method in Claim 17, wherein the thickness of said piezoelectric/electrostrictive film element is 5-30 μm.

19. The method in Claim 1, wherein said piezoelectric/electrostrictive film element is thermally treated at 150-300°C.

Sub B1 20. A piezoelectric/electrostrictive film element produced by a method comprising the steps of :

A) preparing a solution or a dispersed mixture containing constituent ceramic elements by dissolving or dispersing the raw material of constituent ceramic elements in a solvent or dispersion medium;

B) preparing a mixed solution by adding citric acid into said solution or said dispersed mixture in which said constituent ceramic elements are dissolved or dispersed;

C) getting ultrafine ceramic oxide powder of particle size less than 1 μm with uniform particle diameter size distribution by forming ceramic oxide without scattering over, by nonexplosive oxidative-reductive combustion reaction by thermally treating said mixed solution at 100-500°C;

D) preparing a suspension by dispersing said ultrafine ceramic oxide powder in an organic dispersant;

E) preparing ceramic sol solution by dissolving constituent ceramic elements of same or similar constituent with said ultrafine ceramic oxide powder in water or an organic solvent;

F) dispersing by mixing said suspension in which said ultrafine ceramic oxide powder is dispersed with said ceramic sol solution;

G) forming a piezoelectric/electrostrictive film element by submerging a substrate into said suspension which said ultrafine ceramic oxide powder and said ceramic sol solution are mixed and

then by performing electrophoretic deposition; and

H) thermally treating said piezoelectric/electrostrictive film element at 100-600°C,

so that said solvent is removed by said thermal treatment and

the bonding among said ultrafine ceramic oxide powder particles is induced while said ceramic sol acts as a reaction medium on the surfaces of said ceramic oxide particles.

21. The piezoelectric/electrostrictive film element in Claim 20, wherein the method further comprises a step of thermally treating said ultrafine ceramic oxide powder at 700-900°C before D).

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22. The piezoelectric/electrostrictive film element in Claim 20 or Claim 21, wherein the method further comprises a step of drying said piezoelectric/electrostrictive film between G) and H).

23. The piezoelectric/electrostrictive film element in Claim 22, wherein said piezoelectric/electrostrictive film is dried at 70-100°C.

24. The piezoelectric/electrostrictive film element in Claim 20, wherein the particle size of said ultrafine ceramic oxide powder is 0.01-0.1 μm.

25. The piezoelectric/electrostrictive film element in Claim 20, wherein said substrate is made of metal, resinous polymeric organic compound, or ceramic.

26. The piezoelectric/electrostrictive film element in Claim 25, wherein said metal is nickel (Ni) or stainless steel.

27. The piezoelectric/electrostrictive film element in Claim

25, wherein said resinous polymeric organic compound is polyester, polyimide, or teflon-based resin.

28. The piezoelectric/electrostrictive film element in Claim 25, wherein said ceramic is alumina (Al_2O_3), zirconia (ZrO_2), silicon (Si), silicon carbide (SiC), silicon nitride (Si_3N_4), silicon dioxide (SiO_2), or glasses.

29. The piezoelectric/electrostrictive film element in Claim 20, wherein said ultrafine ceramic oxide includes lead (Pb), zirconium (Zr) and titanium (Ti).

30. The piezoelectric/electrostrictive film element in Claim 29, wherein said ultrafine ceramic oxide is PZT, PMN or their solid solution (PZT-PMN) complex oxide.

31. The piezoelectric/electrostrictive film element in Claim 30, wherein said ceramic oxide powder further includes one or more element among nickel (Ni), lanthanum (La), barium (Ba), zinc (Zn), lithium (Li), cobalt (Co), cadmium (Cd), cerium (Ce), chromium (Cr), antimony (Sb), iron (Fe), yttrium (Y), tantalum (Ta), tungsten (W), strontium (Sr), calcium (Ca), bismuth (Bi), tin (Sn) and manganese (Mn).

32. The piezoelectric/electrostrictive film element in Claim 20, wherein said organic dispersion medium in which said ultrafine ceramic oxide powder is dispersed is alcohols or acetones.

33. The piezoelectric/electrostrictive film element in Claim 20, wherein the content of said organic dispersant is 1-500 ml per gram of the ultrafine ceramic oxide powder which is dispersed.

34. The piezoelectric/electrostrictive film element in Claim

20, wherein said organic solvent which is a base of said ceramic sol solution is acetic acid, dimethyl formamide, methoxyethanol, alcohols, or glycols.

35. The piezoelectric/electrostrictive film element in Claim 20, wherein the content of said ceramic sol solution is 1-500 parts by weight based on the weight of said ceramic oxide powder when the suspension of said ultrafine ceramic oxide powder and said ceramic sol solution are mixed.

36. The piezoelectric/electrostrictive film element in Claim 20, wherein the thickness of said piezoelectric/electrostrictive film element is 1-100 μm.

37. The piezoelectric/electrostrictive film element in Claim 36, wherein the thickness of said piezoelectric/electrostrictive film element is 5-30 μm.

38. The piezoelectric/electrostrictive film element in Claim 20, wherein said piezoelectric/electrostrictive film element is thermally thermaled at 150-300°C.

39. A piezoelectric/electrostrictive film produced by the steps of:

A) preparing ceramic oxide powder by a non-explosive oxidative-reductive combustion reaction at a low temperature of 100-500°C, said ceramic oxide powder having a grain size of 1 μm or less and including lead (Pb) and titanium (Ti) as its basic constituents;

B) preparing ceramic sol solution by using an organic solvent or water as a base, said ceramic sol solution having constituents which are identical or similar to those of said ceramic oxide powder;

C) preparing suspension by dispersing said ultrafine ceramic powder into an organic dispersive medium;

D) obtaining dispersive mixture by mixing said suspension with said ceramic sol solution;

E) producing the piezoelectric/electrostrictive film by dipping a substrate into said dispersive mixture, and then performing electrophoretic deposition; and

E) thermally treating said piezoelectric/electrostrictive film at a temperature of 100-600°C, thereby removing said solvent, said ceramic sol solution serving as a reaction medium on the surfaces of ceramic oxide powder so that said oxide powder are coupled together.

40. The piezoelectric/electrostrictive film element in Claim 39, wherein the method further comprises a step of thermally treating said ultrafine ceramic oxide powder at 700-900°C before D).

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41. The piezoelectric/electrostrictive film element in Claim 39 or Claim 40, wherein the method further comprises a step of drying the piezoelectric/electrostrictive film between G) and H).

42. The piezoelectric/electrostrictive film element in Claim 41, wherein the piezoelectric/electrostrictive film is dried at 70-100°C.

43. The piezoelectric/electrostrictive film element in Claim 39, wherein the particle size of said ultrafine ceramic oxide powder is 0.01-0.1 μm.

44. The piezoelectric/electrostrictive film element in Claim 39, Wherein said substrate is made of metal, resinous polymeric organic compound, or ceramics.

45. The piezoelectric/electrostrictive film element in Claim 44, wherein said metal is nickel or stainless steel.

46. The piezoelectric/electrostrictive film element in Claim 44, wherein said resinous polymeric organic compound is polyester, polyimide, or teflon-based resin.

47. The piezoelectric/electrostrictive film element in Claim 44, wherein said ceramic is alumina, zirconia, silicon, silicon carbide, silicon nitride, silicon dioxide, or glasses.

48. The piezoelectric/electrostrictive film element in Claim 39, wherein said ultrafine ceramic oxide includes lead (Pb), zirconium (Zr) and titanium (Ti).

49. The piezoelectric/electrostrictive film element in Claim 48, wherein said ultrafine ceramic oxide is PZT, PMN or their solid solution (PZT-PMN) complex oxide.

50. The piezoelectric/electrostrictive film element in Claim 49, wherein said ceramic oxide powder further includes one or more elements among nickel (Ni), lanthanum (La), barium (Ba), zinc (Zn), lithium (Li), cobalt (Co), cadmium (Cd), cerium (Ce), chromium (Cr), antimony (Sb), iron (Fe), yttrium (Y), tantalum (Ta), tungsten (W), strontium (Sr), calcium (Ca), bismuth (Bi), tin (Sn) and manganese (Mn).

51. The piezoelectric/electrostrictive film element in Claim 39, wherein said organic dispersion medium in which said ultrafine ceramic oxide is dispersed is alcohols or acetones.

52. The piezoelectric/electrostrictive film element in Claim 39, wherein the content of said organic dispersant is 1-500 ml per gram of the ultrafine ceramic oxide powder which is dispersed.

53. The piezoelectric/electrostrictive film element in Claim 39, wherein said organic solvent which is a base of said ceramic sol solution is acetic acid, dimethyl formamide, methoxyethanol, alcohols, or glycols.

54. The piezoelectric/electrostrictive film element in Claim 39, wherein the content of said ceramic sol solution is 1-500 parts by weight based on the weight of said ceramic oxide powder when the suspension of said ultrafine ceramic oxide powder and said ceramic sol solution are mixed.

55. The piezoelectric/electrostrictive film element in Claim 39, wherein the thickness of said piezoelectric/electrostrictive film element is 1-100 μm.

56. The piezoelectric/electrostrictive film element in Claim 55, wherein the thickness of said piezoelectric/electrostrictive film element is 5-30 μm.

57. The piezoelectric/electrostrictive film element in Claim 39, wherein said piezoelectric/electrostrictive film element is thermally thermaled at 150-300°C.

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